Spontaneous coronary artery dissection: a neglected cause of acute myocardial ischaemia and sudden death

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Abstract

Spontaneous coronary artery dissection is a rare cause of acute myocardial ischaemia. Eight consecutive fatal cases which occurred in women aged 34–54 years (mean 43) are described. The dissection involved the left anterior descending coronary artery in four, the left main trunk in two, the right coronary artery in one, and both left anterior descending and circumflex arteries in one. The clinical presentation was sudden death in six cases, and acute myocardial infarction in two. Diagnosis was made at necropsy in every case but one, in which coronary dissection was diagnosed during life by selective coronary angiography. The only ascertained risk factor was hypertension in one patient; none of the women was in the puerperium, and Marfan syndrome was excluded in all. Histology showed a haematoma between the coronary tunica media and adventitia, that flattened and occluded the lumen; a coronary intimal tear was detected in only two cases. Unusual histological findings were cystic medial necrosis in one case, eosinophilic inflammatory infiltrates in four, and angiomatosis of the tunica adventitia in one. Patients dying of spontaneous coronary dissection are usually middle aged women, with no coronary atherosclerosis and apparently no risk factors. Spontaneous coronary artery dissection is unpredictable, and sudden death is the usual mode of clinical presentation. Prompt diagnosis and life saving treatment is far from being achieved.

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Spontaneous coronary artery dissection, a rare condition responsible for acute myocardial ischaemia, was first described in 1931 in a 42 year old white woman who died suddenly after experiencing chest pain.[1] Since then more than 100 cases have been reported in English language journals,[2–5] mostly in young, otherwise healthy women, particularly in the puerperium.

In this report we describe the clinical and morphological features of isolated spontaneous coronary artery dissection in eight necropsy cases, all females, none of whom was in the puerperium.

Methods and definitions

Spontaneous coronary artery dissection has been defined as an intramural haematoma of the media of the vessel wall (false lumen) which flattens the true lumen, leading to blood flow obstruction and acute myocardial ischaemia, in the absence of trauma or iatrogenic causes.

A review of our anatomical collection of heart specimens since 1985 showed eight necropsy cases that fulfilled these criteria. The clinical records in these subjects were reviewed. After excluding cardiac and extracardiac causes of death, the heart specimens were first inspected macroscopically. Subsequently, the four major epicardial trunks (left main, left anterior descending, left circumflex, and right coronary artery) were examined by cutting them into serial cross sections at 3 mm intervals. These coronary specimens were then dehydrated, embedded in paraffin, and stained with haematoxylin-eosin, Weigert-Van Gieson, Azan Mallory, and Alcian PAS. The myocardium was also examined macroscopically and microscopically for myocardial ischaemic damage.

Results

The eight cases of spontaneous coronary artery dissection were all women, ranging in age from 34 to 54 years (mean 43). The most important clinical and pathological findings are summarised in the table.

Coronary artery dissections: main clinical and pathological findings

Case No	*Sex age*	*Clinical presentation*	*Circumstances of death*	*Risk factors*	*Coronary site*	*Histology*
1	F, 34	Sudden death	At rest	—	LDA	—
2	F, 54	Sudden death	At rest	—	RCA	Cystic medial necrosis
3	F, 43	Sudden death	At rest	Hypertension	LDA	Eosinophilic infiltrate
4	F, 50	Sudden death	At rest	—	LDA	Eosinophilic infiltrate
5	F, 45	Myocardial infarction	At rest	—	LMC	Intimal teat
6	F, 48	Myocardial infarction	At rest	—	LDA, CX	Intimal tear, angiomatosis, eosinophilic infiltrate
7	F, 35	Sudden death	At rest	—	LDA	—
8	F, 37	Sudden death	After strenuous effort	—	LMC	Eosinophilic infiltrate

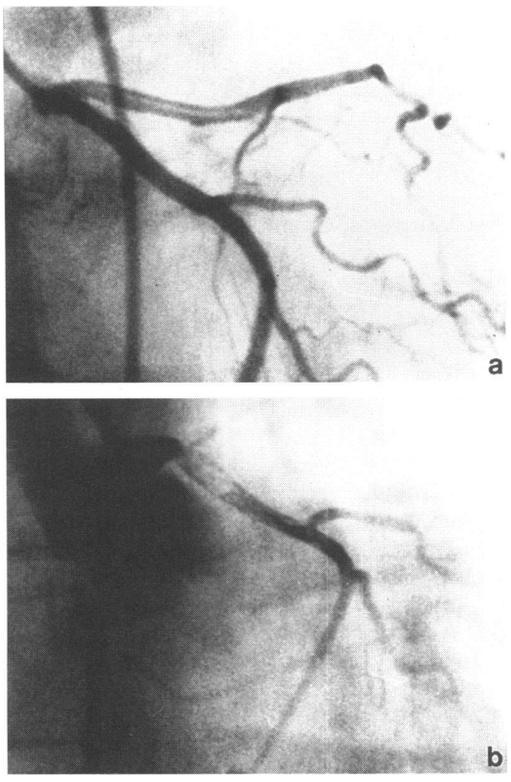

Figure 1 A 48 year old woman with acute anterior myocardial infarction (case No 6). (a) Selective left coronary angiography at baseline (frontal view): detection of two lumina separated by a radiolucent flap in the proximal as well as in the mid-third of the left anterior descending coronary artery. (b) Selective left coronary angiography (frontal view) at onset of acute ischaemia during catheterisation: stoppage of blood flow to the entire left anterior descending coronary system.

None of the patients had a previous cardiac history, and the only ascertained risk factor was hypertension in one (case No 3); Marfan syndrome was excluded in all. None of these women was in the puerperium or was known to have been taking oral contraceptives. None was a smoker; none had a history of illicit drug use; and toxicological examination was negative in every case. One patient had performed intense physical exercise (swimming) without prior training two hours before the fatal event (case No 8). In six subjects, the clinical presentation was sudden death. Two patients (cases Nos 5 and 6) had complained of precordial chest pain, and died of anterior acute myocardial infarction six hours and eight days later, respectively. Diagnosis was achieved in life only in case No 6, in whom selective coronary angiography was performed eight days after an acute myocardial infarction (fig 1).

At necropsy, heart weights ranged from 280 to 340 g (mean 310). The dissection involved the left anterior descending coronary artery in four cases, the left main trunk in two, the right coronary artery in one, and both the left anterior descending and circumflex arteries in one. Coronary atherosclerosis was absent in all. Morphological evidence of anterior acute myocardial infarction was present in two cases. Histological examination of the involved coronary segments showed a more or less concentric haematoma, located between the coronary tunica media and adventitia, which flattened and occluded the lumen (fig 2). Although serial histological sections were examined, intimal tears connecting the true lumen with the intramural hematoma were observed in only two cases. Unusual histological findings were cystic medial necrosis in one case, angiomatosis of the tunica adventitia in one and adventitial-periadventitial eosinophilic infiltrates in four (fig 2b). Signs of hyperacute ischaemic damage in the tributary myocardium of the involved coronary artery, consisting of contraction band necrosis, were always observed in the cases of sudden death. Myocardial infarctions showed the classical picture of coagulation necrosis at various stage of healing.

Discussion

Spontaneous coronary artery dissection, also known as dissecting aneurysm, intramural haemorrhage or haematoma, is an uncommon morbid entity.[1-5] The dissection usually occurs in the outer media and determines luminal occlusion by pushing the inner media against the opposing wall. Clot filling the false lumen may simulate coronary thrombosis at the naked eye, masking the dissection. Thus the real incidence of this entity may be underestimated at necropsy, unless a careful histological examination of the coronary segment is conducted.

A review of published reports showed that 69% of the cases were diagnosed at necropsy.[5] About 80% of the cases occurred in women, and more than 25% of these were in the peripartum period.[6-20] Dissection of the right coronary artery seems to be more frequent in men, whereas dissection of the left anterior descending coronary artery appears more common in women. Coronary artery dissection affects young adults; in a series of cases that were diagnosed before death, De Maio *et al*[4] found a mean age of 46 years in males and 38 years in females. The clinical presentation of this entity includes the entire spectrum of coronary syndromes, and is primarily related to the extent of the dissection and the vessel involved. Nonetheless, sudden death without evidence of myocardial infarction is much more frequent.[21] Survival is possible if obstruction of the lumen is not complete, or if a myocardial infarction develops without fatal complications.[22-25] Spontaneous healing of a coronary dissection has also been shown to occur, on both clinical and histological evidence.[11 24]

When secondary causes, such as aortic dissection, trauma, coronary angiography, angioplasty, or surgical manipulations are excluded,[9 13 22 26-34] the aetiology of spontaneous coronary artery dissection remains uncertain. Most of the patients do not have risk factors for coronary artery disease, and hypertension has rarely been reported.[9]

Arterial wall changes during pregnancy or the use of oral contraceptives have been well documented[35]; hormonal and haemodynamic factors may result in a weakening of the tunica media, thereby explaining the higher incidence of female patients with spontaneous coronary dissection in the puerperium.[6-14 36 37] However, in our experience, none of the women was in the peripartum period, or taking oral contraceptives.

A true pattern of cystic medial necrosis has rarely been described in the involved coronary artery as the cause of spontaneous coronary artery dissection.[38-40]

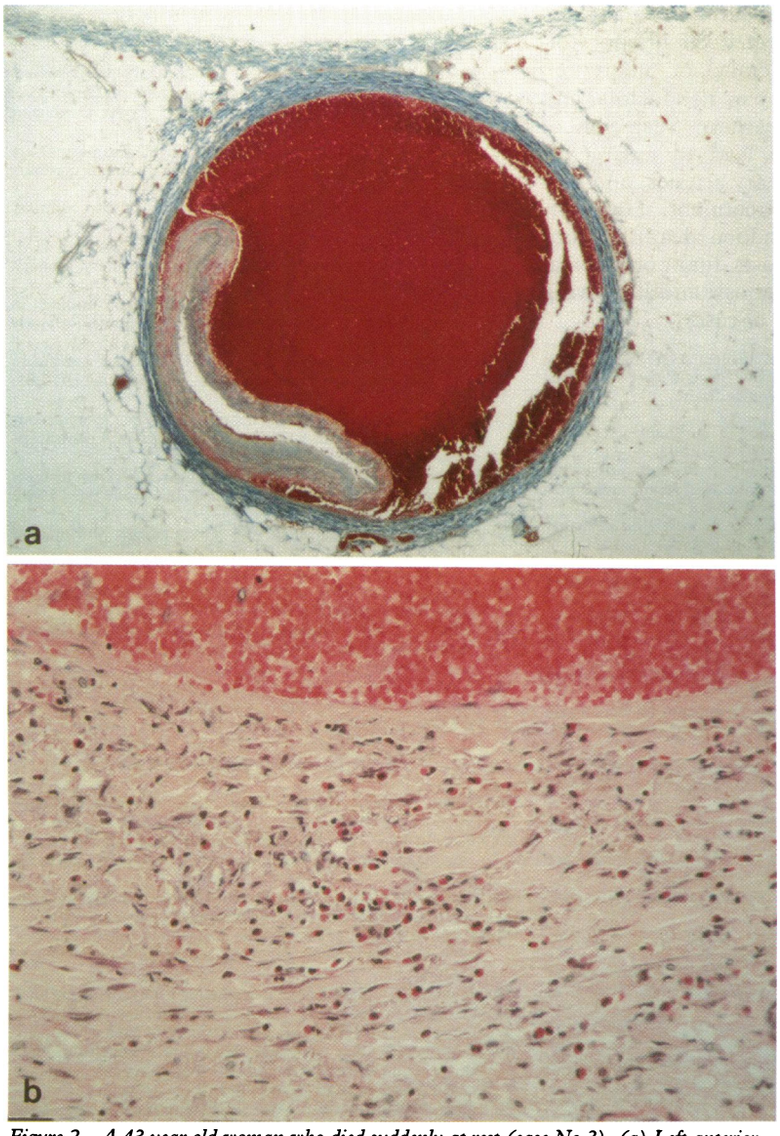

Figure 2 A 43 year old woman who died suddenly at rest (case No 3). (a) Left anterior descending coronary artery occluded by dissecting haematoma. Azan-Mallory stain, magnification × 17·5. (b) Eosinophilic infiltrates in the adventitia. HE stain, magnification × 132.

The vasa vasorum have been implicated as a possible initiating site for coronary dissection; they may be abnormal in this group of patients, as in our case of angiomatosis, and in some way fragile and susceptible to haemorrhage,[41] thus constituting the initial source of bleeding.

As in aortic dissection, the source of the blood could be the true lumen through an intimal tear, which has been detected in a few cases.[42–45] However, we observed an intimal tear in only two cases on serial histological sections, and we do not know whether it was the site of intramural ingress or egress of blood. One of these cases displayed both angiomatosis and eosinophilic infiltrates in the tunica adventitia, highly suggestive of a primary intramural haematoma.

In many published cases, as well as in four from our own series, a fairly diffuse adventitial and periadventitial inflammatory reaction, consisting mainly of eosinophils, was observed.[2 27 28 46–48] Because of the presence of these "periarteritis-like" adventitial changes, it was proposed that the dissection is a result of lytic action of protease released from eosinophils.[28] However, it is likely that the periadventitial inflammation seen in some cases is reactive in nature, rather than causative.[48]

Intense physical exercise as a precipitating factor of coronary artery dissection has already been described.[49 50] Noteworthy is a recent report of cocaine induced coronary artery dissection, which adds this entity to the long list of cardiovascular complications of cocaine abuse.[51]

The in vivo diagnosis of spontaneous coronary artery dissection by selective angiography depends on the visualisation of two lumina separated by a radiolucent intimal flap.[5 52–54] This procedure entails the risk of cardiac arrest by injection of hypertonic medium into the false lumen, thus aggravating the dissection. Some cases may not be recognised if an intimal tear does not occur or if the true lumen is severely narrowed or if the false lumen is occluded by a clot.

The prognosis for these patients is poor. In a survey of 123 cases, Benham and Tillinghast found that 67% of the patients died and 33% survived, treated either surgically or medically.[55] Since sudden death is the most frequent clinical presentation, the clinician is left without the time of any potential therapeutic option in the majority of cases. Medical treatment may play a palliative role. Ramamurti *et al* first reported the use of intravenous streptokinase in a case with left anterior descending coronary artery dissection.[56] Several workers think that this treatment may be effective in lysing the clot in the false lumen and in re-establishing patency of the true lumen[55]; nonetheless, we wonder whether thrombolysis might aggravate the bleeding, thus worsening the coronary dissection.

Although the outcome for patients with spontaneous coronary dissection is considered grim, with a high mortality rate, aggressive surgical treatment in a recent series of 10 consecutive patients resulted in 100% survival.[5]

Forker *et al* carried out the first operation for a spontaneous dissection of the right coronary artery in 1969 by performing an aorto-coronary bypass.[57] Thayer *et al*[3] recommended coronary artery bypass grafting for all patients with spontaneous dissection, whereas De Maio *et al*[4] advocated this intervention only in cases of left main disease, three vessel disease, or recurrent ischaemia. Indeed, this technical approach may be considerably difficult in the setting of vessel wall dissection, with the false lumen underlying the site of graft anastomosis.[58] Successful surgical repair by extrusion of the intramural haematoma was reported in 1986 by Vicari *et al*.[59] In cases of severe heart failure following myocardial infarction caused by coronary artery dissection, cardiac transplantation has been performed and total artificial heart implantation attempted as a temporary measure.[60 61] Nowadays, new interventional techniques, such as stents and ballons, are being considered for the management of coronary dissection.[62 63]

In conclusion, the possibility of a spontaneous coronary artery dissection should be

considered in any young adult woman who presents with an unexpected circulatory collapse, myocardial ischaemia, or infarction, without a previous history or risk factors, and not necessarily in puerperium. Suspicion of the diagnosis may then lead to emergency investigation of the coronary arteries, and surgical or interventional treatment. However, the high incidence of sudden death without premonitory symptoms casts doubt on the real possibility of prompt diagnosis and life saving treatment in the majority of cases.

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